1. Today 1 British pound is worth 1.6 dollars. If the value of the pound in dollars increases by 12.5%, approximately how many pounds will 72 dollars be worth then?

A. 35 B. 36 C. 39 D. 40 E. 42

2. The number 356xy is a multiple of 9 and has 5 different digits. If $x < y$, find $2x + y$.

A. 15 B. 17 C. 18 D. 19 E. 21

3. The equation AMA + TYC = SML is converted to an equation involving three 3-digit numbers by replacing identical letters by the same digit 0 to 9, and different letters by different digits 0 to 9. If B is the set of all possible values of M for which A = 7, which of the following is a subset of B?

A. {0,1} B. {2,3} C. {4,5} D. {6,7} E. {8,9}

4. Knaves always lie; knights always tell the truth. Al says, "Bo and Cy are knaves," Bo says, "Cy is a knave," and Cy says, "Al is a knight". If Al, Bo, and Cy are each either a knight or a knave, it is true that

A. Al and Cy are both knights B. Al and Cy are both knaves
C. Al is a knight, Cy is a knave D. Al is a knave, Cy is a knight
E. it cannot be determined what Al and Cy are

5. A sequence has the property that every term except the first is the average of its predecessor and successor terms. If the sequence's first two terms are 5 and 8, find the 100th term of the sequence.

A. 302 B. 305 C. 307 D. 308 E. 310

6. The solution to the equation $(\log_6 x^4)(\log_x 6)^2 = 2$ satisfies the inequality

A. $0 < x \leq 1$ B. $1 < x \leq 10$ C. $10 < x \leq 50$ D. $50 < x \leq 100$ E. $x > 100$

7. The equation $a^5 + 3b^2 + c^2 = 2013$ has a solution in positive integers with $a + b > c$. For this solution, find $a + b + c$. A. 45 B. 47 C. 49 D. 51 E. 53

8. Let S = {3, 5, 7, 11, 13, 17}. How many elements of S are factors of $2^{60} - 1$?

A. 2 B. 3 C. 4 D. 5 E. 6

9. A student is chosen at random from a math class. The probability the student is a senior, given the student is female, is 64%, and the probability the student is a senior math major, given the student is female, is 36%. Find the probability the student is a math major, given the student is a female senior.

A. 7/25 B. 7/16 C. 12/25 D. 11/20 E. 9/16

10. The fraction a/b (a, b positive integers) equals 0.127 when rounded to 3 decimal places, while $(a + 1)/(b + 1)$ equals 0.143 rounded to three decimal places. Find a + b.

A. 59 B. 60 C. 61 D. 62 E. 63

11. How many nonempty subsets A of {1, 2, 3, 4, . . ., 10} have the property that no two elements of A sum to 11?

A. 216 B. 220 C. 240 D. 242 E. 256

12. Ed rolls a fair 6-sided die, winning if he rolls a 1 or 2. If he doesn't win, Ho then rolls the die, winning if he rolls a 3, 4, 5, or 6. If he doesn't win, Ed rolls again, and they alternate rolls in this way until someone wins. The probability that Ed wins is

A. 1/3 B. 2/5 C. 3/7 D. 1/2 E. 5/9

13. In ΔABC, D is a point on side BC for which BD = 20. If AC = 24 and $m\angle CAD = m\angle ABD$, find CD.

A. 16 B. 18 C. 20 D. 24 E. 36

14. A woodworker makes bowls and boxes. Bowls need 1 hr of carving and 2 hr of finishing; boxes need 2 hr of carving and 1 hr of finishing. She has 20 hr each of carving and finishing time each week. If she can sell all her products each week and bowls and boxes earn profits of $4 and $3 each respectively, to maximize profit she should make

A. no boxes B. 6 boxes C. 7 boxes D. 8 boxes E. 10 boxes

15. There are 4 integers N and bases b and b+2 ($b < 10$) for which (1) N has a 4-digit representation in both bases, and (2) if $N_b = pqrs$, then $N_{b+2} = qrsp$. For the smallest b for which this is true, write the base-10 representation of the corresponding N in the blank on the answer sheet.

16. Let ΔABC be an equilateral triangle with side 30 and let O be its centroid. Point X is chosen at random from all points inside ΔABC such that the circle of radius 3 centered at X lies entirely on or inside ΔABC. The probability that O is on or inside the chosen circle can be written in the form $\pi/(a*\text{sqrt}(3) - b)$. Find a + b.

A. 52 B. 54 C. 55 D. 56 E. 58

17. Let S be the 32-element set of all 5-letter strings of a's and b's. Call two different strings *equivalent* if (1) one is the reversal of the other (like abbab and babba); (2) one is the complement of the other (where a's become b's and b's become a's, like abbab and baaba); or (3) one is the complement of the other's reversal (like abbab and abaab). Find the size of the largest possible subset of S in which no two elements are equivalent.

A. 8 B. 10 C. 12 D. 14 E. 16

18. The equation $ax^4 + bx^3 + cx^2 + dx + e = 0$ has 4 distinct solutions. If all coefficients are integers and a, b, and e are odd, the maximum number of rational solutions is

A. 0 B. 1 C. 2 D. 3 E. 4